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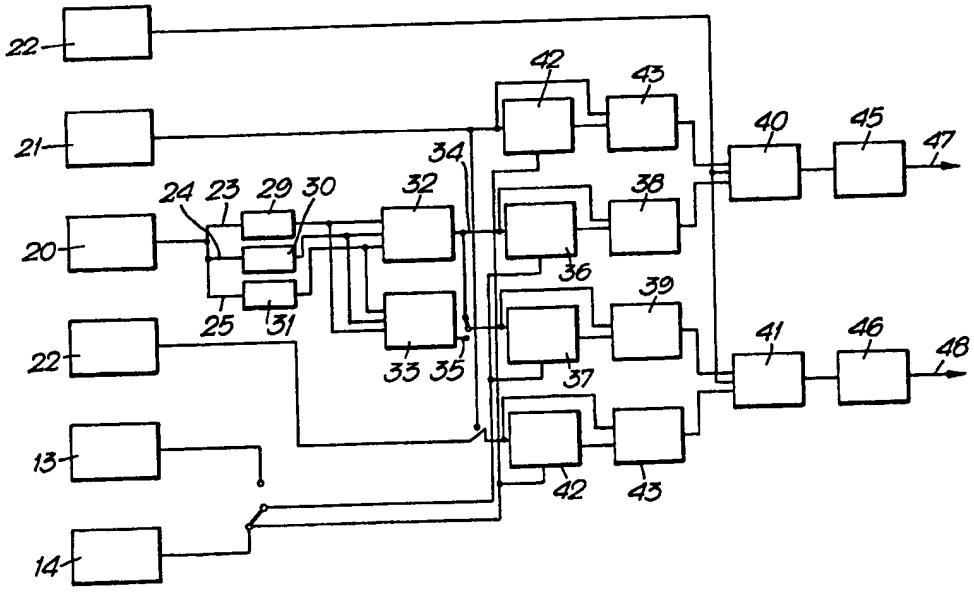
(54) Sound profile generator

(57) A sound generator for masking the effects of Tinnitus, including respective means for causing the masking sound generated by the sound generator to include one or more white noise components, one or more pure tone components, and one or more components audible as a clicking noise; the sound generator further including frequency control means for varying the frequency of each component, control means to alter the noise envelope of the or each white noise or pure tone component; volume control means for varying the volume of each component and means for mixing the components to produce said masking sound.

Fig.4.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig.1.

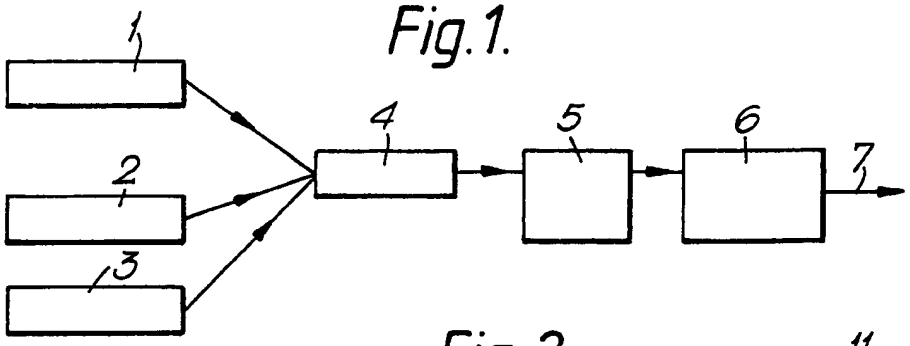


Fig.2.

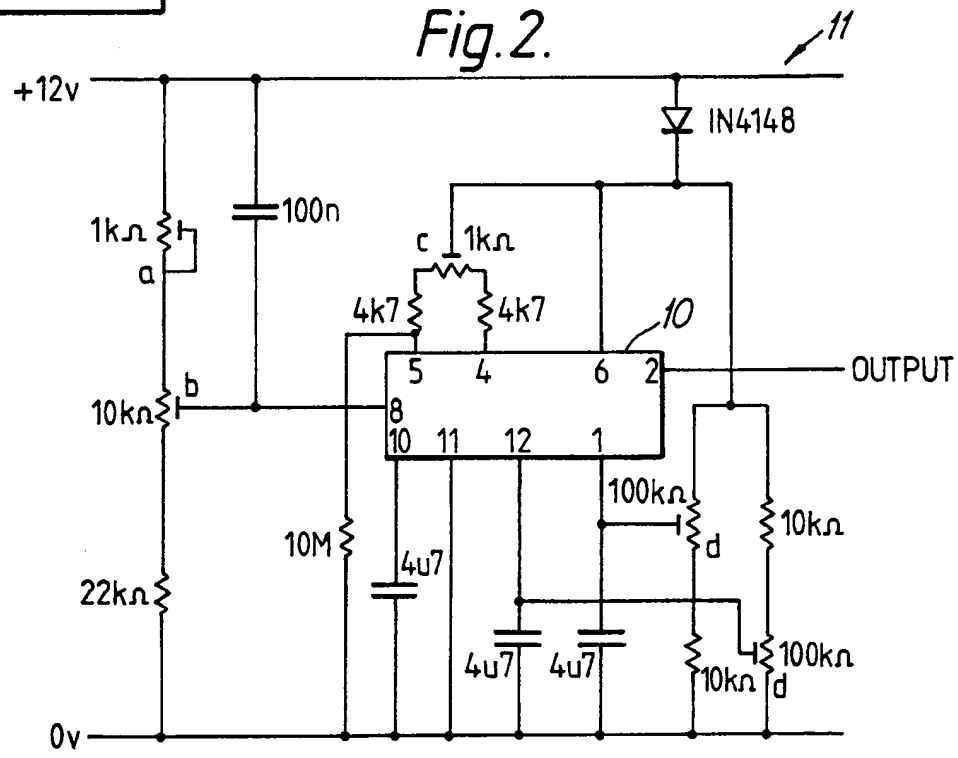


Fig.3.

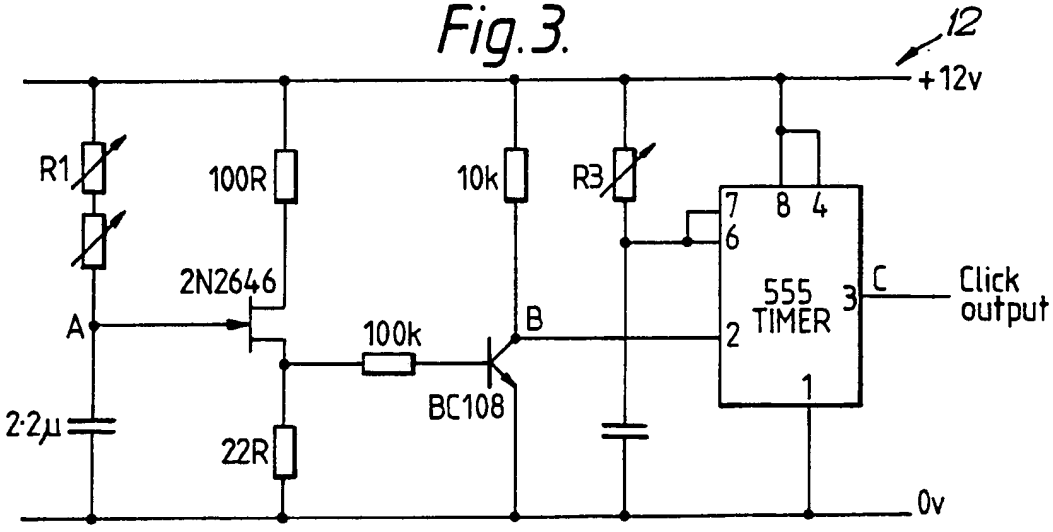
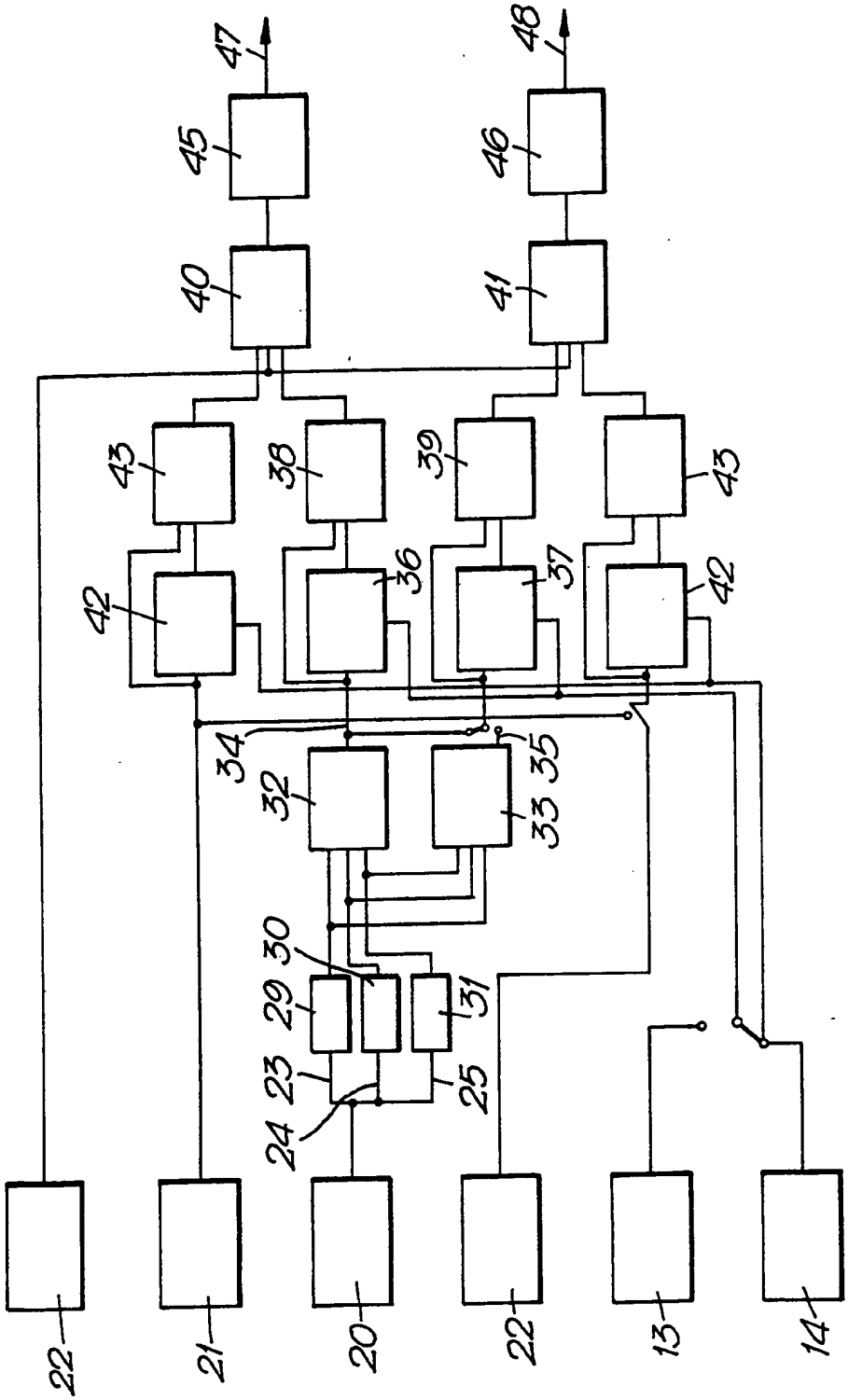


Fig. 4.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SOUND PROFILE GENERATOR

This invention relates to a masking sound profile generator for use in the alleviation of Tinnitus.

Tinnitus is a condition in which a sensation of noise is perceived by a subject in the absence of an external sound, possibly as a result of smal' abnormalities in the cochlea or noise generation in the nerves. These sounds are generally inaudible to other people and may take the form of ringing, whistling and buzzing for example.

It is known that some Tinnitus sufferers can gain relief by listening to Tinnitus - like sounds, ie the kind of sounds which they appear to 'hear' due to the Tinnitus. The real sounds act as if to mask out the apparent sounds. The nature of the listened to sounds is important - it has to be adjusted for different subjects and, as we have found, should contain varying degrees of different types of noise component.

The object of the present invention is to provide a sound generator which provides a more effective mask sound profile of which the various components can be adjusted to suit different subjects.

According to the present invention there is provided a sound generator for masking the effects of Tinnitus, including respective means for causing the masking sound generated by the sound generator to include one or more white noise components, one or more pure tone components, and one or more components audible as a clicking noise; the sound generator further including frequency control means for varying the

frequency of each component, control means to alter the noise envelope of the or each white noise or pure tone component; volume control means for varying the volume of each component and means for mixing the components to produce said masking sound.

Reference will now be made by way of example to the accompanying drawings in which:-

Figure 1 is a block diagram of part of a masking sound generator;

Figure 2 is a circuit diagram of a pure tone supply means used in the Figure 1 generator;

Figure 3 is a circuit diagram of a click generator and

Figure 4 is a more detailed block diagram of the masking sound generator.

In order to mask Tinnitus in a subject, the generator illustrated attempts to provide a noise signal that is an approximation of the apparent sound heard by the subject. The noise signal includes a white noise component, pure tones and clicks all of variable frequency and volume. By mixing these three different components, a range of "Tinnitus like" sounds may be approximated.

Figure 1 shows white noise 1, pure tones 2, and clicks 3 being mixed by a mixer 4 and modulated via an amplifier 5 fed to a power amplifier 6, to produce a stereo output 7.

The white noise may be passed via respective filters to produce waveforms of different frequency bands namely:-

0Hz - 500 Hz - low frequency

500Hz - 6KHz - middle frequency

6KHz - 20KHz - high frequency

The pure tone is likely to be in the frequency range of 30Hz - 20KHz and the clicks are likely to be of frequency 0.25Hz - 100Hz. The relative loudness of each wave form should be volume controllable.

Figures 2 and 3 show possible circuits for producing the pure tones and clicks respectively.

Referring to Figure 2, in order to create a pure tone it is necessary to have an oscillator capable of producing a sine wave which is continually variable across most of the audio range. An RS8038 waveform IC 10 is one of a number of devices which can form such a sine wave and is shown in a typical circuit 11 as specified in RS data sheet 2141.

Figure 3 shows a click generator circuit 12 which produces a square wave with a constant mark width of 1ms and of variable space width.

The white noise may be produced in any known manner in accordance with the requirements above.

Referring to Figure 4, having generated the 3 different types of signals; white noise 20, two pure tones 21 and clicks 22, each must undergo signal processing in order that a suitable stereo output can be produced.

The white noise is separated into components 23, 24 and 25 by filtering through respective low-pass, mid-pass and high-pass filters 29, 30 and 31. Each component is then split and fed into one mixer 32 for channel A and one mixer 33 for channel B. The resultant output signals 34 and 35 respectively are split, one part being modulated via respective voltage control amplifiers 36 and 37. The modulated and non-modulated components of signals 34 and 35 are then recombined by balance

mixers 38 and 39 respectively before being fed into final stage mixers 40 and 41 for respective channels A and B.

The click output 22 is split and passed directly into the final stage mixers 40 and 41.

Each of the pure tone signals 21 are split and one component of each signal is amplitude modulated via voltage controlled amplifiers 42. The modulated and non-modulated components of each signal are then recombined by balance mixers 43. The mixed outputs are then fed into respective mixers 40 and 41. The outputs from these final stage mixers are then passed to power amplifiers 45 and 46 which control the volume of each of the channel A and B outputs 47 and 48 respectively.

The voltage control amplifiers 36, 37 and 42 are all provided with envelope shaping controls. These take the form of a triangular wave form generator 13 and a pulse generator 14. These can cause the voltage control amplifiers to produce pulse, triangular or constant wave envelopes for the white noise; and pulsed or constant wave envelopes for the pure tones.

The output sound is adjusted by means of varying the frequency and volume of each of the component waveforms 20, 21 and 22 such that the final output sound is similar to the Tinnitus heard by the subject. This output may then be recorded and played back at anytime when the subject experiences the compliant in order to mask the Tinnitus.

It should be noted that any suitable filter, voltage controlled amplifier, balance mixer and mixer circuits may be used in the system provided.

CLAIMS

1. A sound generator for masking the effects of Tinnitus, including respective means for causing the masking sound generated by the sound generator to include one or more white noise components, one or more pure tone components, and one or more components audible as a clicking noise; the sound generator further including frequency control means for varying the frequency of each component, control means to alter the noise envelope of the or each white noise or pure tone component; volume control means for varying the volume of each component and means for mixing the components to produce said masking sound.

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